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SPECIFICATION FOR SILICON BRONZE INGOTS AND CASTINGS

(Second Revision)

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SPECIFICATION FOR SILICON BRONZE INGOTS AND CASTINGS

(Second Revision)

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Indian Standard

SPECIFICATION FOR SILICON BRONZE INGOTS AND CASTINGS

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards on 25 June 1987, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1956 and revised in 1970. In this revision, the following modifications have been incorporated:

a) MKS units have been changed to SI units for all quantities and dimensions;

b) Chemical composition has been modified;

c) Clauses on terminology, pressure test, and shape and dimensions have been added;

d) Sampling and criteria for conformity has been modified, and

e) An Appendix 'A', containing information to be given by the purchaser, has been added.

0.3 Silicon bronze castings are used in sewage disposal equipment, chemical process equipment, marine hardware and anti-corrosive pipe fittings, such as valves and pumps. Silicon bronze may also provide a good substitute for tin and tin-zinc-bronzes.

0.3.1 Attention may be drawn to the fact that where the specified minimum tensile properties apply to separately cast standard test bars, these properties may not be realized in all parts of the castings.

0.4 This standard contains **4.2, 4.3, 6.1, 8.2, 8.3, 9.1, 10.0, 10.2** and **12.1**, where the purchaser is allowed to exercise his option and which calls for an agreement between the purchaser and the supplier.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers requirements for silicon bronze ingots and castings.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions, as given in IS : 3288 (Part 2)-1986*, shall apply.

2.1 Ingot — A cast product in a form suitable for remelting primarily for the production of copper and copper alloys.

2.2 Casting — A general term for products at or near net shape, formed by solidification of a molten metal or alloy in a mould.

3. SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of material shall be as laid down in IS : 1387-1967†.

4. CHEMICAL COMPOSITION

4.1 The material shall have the chemical composition as given in Table1.

TABLE 1 CHEMICAL COMPOSITION OF SILICON BRONZE INGOTS AND CASTINGS

CONSTITUENT	PERCENT
Copper, *Min*	89·0
Silicon	1·0-5·0
Zinc, *Max*	5·0
Iron, *Max*	2·5
Manganese, *Max*	1·5
Tin, *Max*	1·0
Lead, *Max*	0·5
Aluminium, *Max*	1·5

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*Glossary of terms relating to copper and copper alloys: Part 2 Unwrought and cast forms.

†General requirements for the supply of metallurgical materials (*first revision*).

4.2 If restricted composition is required by the purchaser, then the permissible variation shall be as follows:

Constituent	*Permissible Variation, Percent*
Silicon	± 0·4
Zinc	± 1·5
Other elements prescribed	± 0·3

4.3 The chemical composition shall be determined either by the methods specified in IS : 4027-1967* and its relevant parts or any other established instrumental/chemical methods. In case of dispute, the procedure specified in IS : 4027-1967* and its relevant parts shall be the referee method.

5. MECHANICAL PROPERTIES

5.1 The mechanical properties of sand cast test pieces of silicon bronze ingots and castings, when selected and prepared in accordance with **10.3** and tested in accordance with IS : 2654-1977†, shall comply with the following requirements:

Tensile strength, *Min*	310 MPa
Elongation on $5·65\sqrt{S_0}$, *Min*	20 percent

6. PRESSURE TEST

6.1 If the purchaser requires castings to be tested for pressure tightness, this shall be stated in the enquiry and order. The number of tests, the nature of test, the test pressure and the testing fluid shall be the subject of agreement between the manufacturer and the purchaser.

7. FREEDOM FROM DEFECTS

7.1 Ingots — The ingots shall be free from harmful defects.

7.2 Castings — The castings shall be clean and free from harmful defects, such as, blow holes, porosity, shrinkage defects or cracks, etc.

8. WORKMANSHIP AND FINISH

8.1 The castings shall be smooth and well cleaned by sand blasting, tumbling, chipping or other processes.

8.2 The castings shall not be repaired, plugged, welded or burned-in, unless permission in writing has been obtained previously from the purchaser.

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*Method of chemical analysis of bronzes.

†Method for tensile testing of copper and copper alloys (*first revision*).

8.3 In case radiographic examination is required by the purchaser, this shall be stated in the enquiry and order.

9. SHAPE AND DIMENSIONS

9.1 Ingots — Shape and dimensions of ingots shall be as agreed to between the manufacturer and the purchaser.

9.2 Castings — The shape and dimensions of the castings shall be in accordance with the drawings. All surfaces marked for machining shall have sufficient allowance for that purpose but this shall not be too excessive resulting in more machining and unnecessary increase in the mass of casting.

10. SAMPLING AND CRITERIA FOR CONFORMITY

10.0 Unless otherwise agreed to between the purchaser and the supplier, the following sampling procedure and criteria for conformity shall hold good.

10.1 Lot — In any consignment, the ingots/castings of same grade, manufactured at the same place under similar conditions, shall be grouped together to constitute a lot.

10.2 Sampling for Chemical Analysis — One sample shall be taken for chemical analysis from each cast of 1 000 kg or part thereof of the ingots/castings. However, in case more frequent chemical analysis is required, the same shall be agreed to between the supplier and the purchaser. Drillings and sawings from ingots or castings shall be obtained in accordance with the appropriate procedure specified in IS : 1817-1961*.

10.2.1 If the test results of chemical analysis, as obtained for each constituent, satisfv the corresponding requirement, the lot shall be considered as conforming to the chemical composition requirements of the specification.

10.3 Sampling for Mechanical Properties — Three test bars shall be separately cast alongwith the castings for tensile strength for every 1 000 kg or part thereof of the castings. These test bars shall be cast to shape in accordance with **4.3.1** and Appendix B of IS : 1408-1968†. These test bars shall be machined to standard dimensions of the test pieces as laid down in IS : 2654-1977‡.

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*Methods of sampling non-ferrous metals for chemical analysis.

†Recommended procedure for inspection of copper base-alloy sand castings (*first revision*).

‡Method for tensile testing of copper and copper alloys (*first revision*).

10.3.1 Out of three test bars, one bar shall be tested for mechanical test for every 1 000 kg or part thereof of castings. If the test results satisfy the requirements of mechanical properties, the lot shall be considered as conforming to the mechanical properties requirements of the specification.

10.4 Retest

10.4.1 If the sample drawn for chemical analysis fails to meet the requirements stipulated in the standard, two more tests shall be conducted on the same sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements, the lot shall be accepted; and if either of the retest fails, the lot represented shall be deemed as not complying with the standard.

10.4.2 If a tensile test piece fails to meet the requirements of the standard, two further test pieces, which represent the same cast/lot, shall be tested in the same manner. If one of the further test pieces meet the requirements of the tensile test, the castings represented thereby shall be deemed to comply with this standard, otherwise the lot shall be rejected.

11. PACKING

11.1 Castings shall be suitably packed to prevent corrosion and damage during transit. Machined surfaces shall be properly protected with anticorrosive compounds.

12. MARKING

12.1 The name, trade-mark of the manufacturer and the cast number shall be cast or otherwise legibly marked by stamping on each ingot or casting. In the case of small castings, where it is difficult to cast on or stamp all the details, the marking may be as agreed to between the purchaser and the supplier.

12.1.1 The material may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

13. TEST CERTIFICATE

13.1 The supplier shall provide test certificate for each consignment giving information like cast number, corresponding chemical composition and mechanical test results.

14. INFORMATION TO BE GIVEN BY THE PURCHASER

14.1 This standard contains a number of clauses in which the purchaser is allowed to exercise an option. The list of information to be given by the purchaser in respect to these clauses is given in Appendix A.

APPENDIX A

(*Clause* 14.1)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1. Whether the purchaser wishes to inspect the material at the supplier's works.

A-2. Detailed drawings of casting.

A-3. In case of ingots, whether purchaser prefers any special size, shape and mass of the ingots.

A-4. Whether pressure test required. If yes, then details like, number of tests, test pressure, test fluid, etc.

A-5. Whether radiographic examination is required.

A-6. Marking details.

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*Sales Office Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, CALCUTTA	27 68 00
† Sales Office is at Novelty Chambers, Grant Road, BOMBAY	89 65 28
‡ Sales Office is at Unity Building, Narasimharaja Square, BANGALORE	22 39 71

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